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73 Patent holder:
Danfoss A/S, Nordborg, DK

74 Representatives:
U. Knoblauch and Associates, 60320 Frankfurt

72 Inventors:
Moelbaek, Jens Joergen, Nordborg, DK

58 Printed publications taken into account in the evaluation of the patentability:

DE-PS	3 83 714
DE-OS	14 98 461
DE-GM	72 22 729
US	42 50 915

JP Abstr. 60-176118(A) in Pat. Abstr. of JP, P-425, Jan. 31, 1986, Vol. 10/No. 28;

The application for examination in accordance with § 44 of the Patent Act has been submitted.

(figure)

54 Diaphragm-controlled differential pressure valve

57 A diaphragm-controlled differential pressure valve, exhibits a valve housing (1), which is constructed in one piece with the lower part (5) of a diaphragm capsule (6). The associated cover (9) carries a spring housing (20) accommodating the set-point spring (18). This results in a valve with a very small height.

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Description

The invention relates to a diaphragm-controlled differential pressure valve, with a valve housing exhibiting an inlet, an outlet, and a valve face cooperating with a closure piece, and with a diaphragm loaded by a set-point spring, whose outer edge is firmly clamped between the lower part and the cover of a diaphragm capsule, whose centre is connected to the closure piece by way of a valve rod and which separates an inner and an outer pressure chamber from one another.

Such a differential pressure valve is known from EP 0 405 339 A2, for example. It exhibits a valve housing with inlet, outlet, and valve face, separated therefrom, a diaphragm capsule, whose lower part has a base for introducing into the valve housing, the base likewise forming a feed-through for the valve rod carrying the closure piece and connected to the diaphragm. The valve rod is hollow. It contains a passage in the region of the feed-through, which connects the inner space of the valve housing with the inner pressure chamber, and is provided with a large cavity in the region of the diaphragm, with the set-point spring arranged in the said cavity. In a central extension of the cover, a regulating device is provided, with which the force of the set-point spring is altered and the travel of the closure piece is limited or the valve completely closed. This construction has a large overall height and takes up much space in the installed position.

The task of the invention lies in specifying a differential pressure valve of the type mentioned in the beginning, which takes up little space.

This task is solved according to the invention in that the lower part of the diaphragm capsule is constructed in one piece with the valve housing and the cover carries a spring housing accommodating the set-point spring.

In this construction, a separate diaphragm capsule as well as a coupling between diaphragm capsule and valve housing are unnecessary. This results not just in a small overall height but also in a substantial reduction in the manufacturing and assembly costs.

It is favourable for the diameter of the diaphragm to be at most only 20% smaller than the length of the valve housing measured between the inlet and outlet. Here, practically the overall length of the valve housing is utilized for the lower part of the diaphragm capsule. Sufficiently large diaphragms can therefore be used.

The inner faces of the lower part and cover advantageously run parallel to one another. A very flat diaphragm capsule is obtained in such a manner, facilitating further reduction of the overall height.

In a preferred embodiment, it is provided for the valve face to be turned away from the diaphragm, and for the valve rod to pass through the valve face, to be guided in a bore hole of the valve housing, and to be connected with the diaphragm in the diaphragm capsule. The valve function arising in the process is suitable, for example, for a differential pressure valve to be installed in the feed pipe of a heating system.

Here, it is favourable for the valve housing on the side turned away from the diaphragm to

exhibit an assembly opening for the introduction of the closure piece and which can be closed by an insert. A very simple installation of the closure piece is provided in this manner.

Other advantage are offered by the fact that the part of the valve rod adjacent to the diaphragm passes in a sealed manner a bore hole in the valve housing, whose diameter is the same as the inner diameter of the valve face, and that the part of the valve rod adjacent to the closure piece has a cross-section smaller than that that of the bore hole. A valve relieved from pressure results from such dimensioning.

In a further embodiment, it is recommended for the valve housing to exhibit on the side turned away from the diaphragm an actuator to be operated manually from the outside for limiting the travel of the closure piece or to close the valve. This actuator does not collide with the diaphragm. It can act directly on the closure piece. It can also be combined with the insert closing the assembly opening.

The valve housing preferably has an opening connecting the inner pressure chamber with the interior of the valve. The inner pressure chamber then acts as a self-pressure chamber. No ducts are required in the valve rod for this.

It is also favourable for the mouth of a pressure line connection to be arranged in the cover in such a way that it can be closed by the diaphragm. When the outer pressure chamber is opened with the differential-pressure valve installed, for example, in order to replace a set-point spring, sealing occurs automatically. The mounted diaphragm separates the outer pressure chamber from the inside of the valve, and moreover, closes the pressure line connection.

It is advisable for the spring housing to be removable and for the set-point spring being supported on its end face to be replaceable. This leads to a very simple construction, in which new desired values are achieved simply by replacing a spring.

In that case, it is advantageous for the cover to have a neck guiding the set-point spring, to the exterior of which the spring housing is fastened. The neck thus has a dual function.

Another likewise recommendable alternative consists in that the spring housing is constructed in one piece with the cover and exhibits an adjusting spindle rotatable from outside with which a supporting element, held in such a way that it cannot rotate, for supporting the spring is axially adjustable. Here, the set-point can be continuously changed.

The invention will be explained in further detail below, using the preferred embodiments presented in the drawing. To illustrate:

Fig. 1 a longitudinal section through a first embodiment of a differential-pressure valve according to the invention, and

Fig. 2 a longitudinal section through a modified embodiment.

The differential-pressure valve illustrated in Fig. 1 comprises a valve housing 1 with an inlet 2 and an outlet 3 as well as a valve seat 4. The top side of the valve housing 1 forms the lower part 5 of a diaphragm capsule 6, which extends over almost the entire axial length of the valve

housing 1. A diaphragm 7 is firmly clamped on its outer edge 8 between the lower part 5 and a cover 9, in which a flared flange 10 of the valve housing 1 engages over the edge of the cover 9. The surfaces of the lower part 5 and the cover 9 facing one another run parallel to one another.

The diaphragm 7 divides the diaphragm capsule 9 into an inner pressure chamber 11, which communicates with the external inner space 13 of the valve housing 1 by way of an opening 12 in the housing wall, and an outer pressure chamber l4, which is connected by way of a pressure line connection 15 to a pressure sensor 16. The mouth 17 of the pressure line connection is located in a flat section of the cover 9 where it can be covered, and consequently closed, by the diaphragm 7. A set-point spring 18 rests on the one hand on the end face 19 of a spring housing 20, and on the other hand, acts on a diaphragm plate 21. The set-point spring 18 is guided by a neck 22, on whose exterior there is a thread 23 for screwing on the spring housing 20. In this way, a set-point spring 18 can be replaced in order to set a particular desired value.

The centre of the diaphragm 7 is firmly clamped between the diaphragm plate 21 and a reinforcing plate 24, in which a screw 25 holds the two plates 21 and 24 facing against a valve stem 26, which at its opposite end supports a closure piece 27, which co-operates with the valve seat 4. The end of the valve rod 26 adjacent to the diaphragm 7 is guided through a bore hole 28 in the valve housing 1 and is sealed there by a seal 29. The diameter of this bore hole 28 is the same as the internal diameter of the valve seat 4. The bore hole 28 and the valve seat 4 can be drilled in one operation. The part 30 of the valve rod 26 adjacent to the closure piece 27 has a smaller cross-section than the bore hole 28. In this manner, a valve relieved of pressure is obtained.

On the side of the valve housing opposite the diaphragm 7 is an assembly opening 31, which can be closed by an insert 32 that can be screwed in. An actuator 33 is arranged in the insert, which can be screwed in by means of the twist grip 34 and is thereby axially adjustable. With this actuator 33, the travel of the closure piece 27 can be limited and if desired, the valve can also be completely closed.

In the assembly, the diaphragm 7 is put into position with the diaphragm plate 21 and the reinforcing plate 24. The valve rod 26 is then introduced through the assembly opening 31 and is connected joined to the diaphragm centre by the screw 26. The insert 32 is then screwed into the assembly opening 31 and the cover 9 is put into position and secured by flanging the flared flange 10. After selecting the desired set-point spring 18, the spring housing 20 can be screwed on. If necessary, the valve rod 26 can be mounted only after the cover 9 has been joined to the lower part 5.

The spring housing 20 can also be removed during operation. The diaphragm 7 prevents water escaping from the inside of the valve, and by covering the mouth 17, prevents water escaping from the pressure sensor 16.

The embodiment of Fig. 2 differs from that of Fig. 1 only in the construction of the cover 35, which is constructed in one piece with a spring housing 36. The set-point spring 37 supports itself on a supporting element 38, held in such a way that it cannot rotate, which is axially adjustable by means of an adjusting spindle. For this purpose, the adjusting spindle 39 has a hexagon socket 40 for rotation and an external thread 41 for axial displacement of the supporting element 38. Such a set-point spring 37 can be adjusted continuously.

In both embodiments the inner pressure chamber 11 forms a self-pressure chamber, which is acted upon by the output pressure of the valve. Such a valve can be installed in particular in the feed pipe of a heating system, in which the upper pressure chamber 14 is provided with the return pressure. However, the basic concept of the invention can also be applied to those differential-pressure valves in which the input pressure impinges on the inner pressure chamber 11, as is the case, for example, with valves arranged in the return line of a heating system.

Patent Claims

1. A diaphragm-controlled differential-pressure valve, with a valve housing exhibiting an inlet, an outlet and a valve seat cooperating with a closure piece, and having a diaphragm loaded by a set-point spring, whose outer edge is firmly clamped between the lower part and the cover of a diaphragm capsule, whose centre is connected by way of a valve rod to the closure piece and which separates an inner and an outer pressure chamber from one another, characterized in that the lower part (5) of the diaphragm capsule (6) is constructed in one piece with the valve housing (1) and the cover (9; 35) supports a spring housing (20; 36) accommodating the set-point spring (18; 37).

2. A valve according to Claim 1, characterized in that the diameter of the diaphragm (7) is at most only about 20% smaller than the length of the valve housing (1) measured between the inlet (2) and the outlet (3).

3. A valve according to Claim 1 or 2, characterized in that the inner faces of the lower part (5) and the cover (9) run parallel to one another.

4. A valve according to one of Claims 1 to 3, characterized in that the valve seat (4) is turned away from the diaphragm (7) and the valve rod (26) passes through the valve seat (7), is guided in a bore hole (28) of the valve housing (1) and is connected in the diaphragm capsule (6) to the diaphragm (7).

5. A valve according to one of Claims 1 to 4, characterized in that the valve housing (1) has on the side turned away from the diaphragm (7) an assembly opening (31) for the introduction of the closure piece (27), which can be closed by an insert (32).

6. A valve according to one of Claims 1 to 5, characterized in that the part of the valve rod (26) adjacent to the diaphragm (7) passes in a sealed manner through a bore hole (28) in the valve housing (1), whose diameter is the same as the inner diameter of the valve seat (4), and that

the part (30) of the valve rod (26) adjacent to the closure piece (27) has a cross-section smaller than that of the bore.

7. A valve according to one of Claims 1 to 6, characterized in that the valve housing (1) exhibits on the side turned away from the diaphragm (7) an actuator (33) to be operated manually from outside to limit the travel of the closure piece (27) or to close the valve.

8. A valve according to one of Claims 1 to 7, characterized in that the valve housing (1) has an opening (12) connecting the inner pressure chamber (11) to the inside (13) of the valve.

9. A valve according to one of Claims 1 to S, characterized in that the mouth (17) of a pressure line connection (15) is arranged in the cover (9) in such a way that it can be closed by the diaphragm (7).

10. A valve according to one of Claims 1 to 9, characterized in that the spring housing (20) is removable and the set-point spring (18) being supported on its end face is replaceable.

11. A valve according to Claim 10, characterized in that the cover (9) exhibits a neck (22) guiding the set-point spring (18), with the spring housing (20) being fastened to the outside of said neck.

12. A valve according to one of Claims 1 to 11, characterized in that the spring housing (36) is constructed in one piece with the cover (35) and that it exhibits an adjusting spindle (39) rotatable from outside, with which a supporting element (38), held in such a way that it cannot rotate, is axially adjustable for supporting the spring (37).

1 page(s) of drawings follow(s)

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DRAWINGS PAGE 1

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AFFIDAVIT

I, Ilse Wong, translator for ALL LANGUAGES LTD, of Toronto, in the Province of Ontario, and a Certified Translator recognized by the Association of Translators and Interpreters of Ontario (ATIO ID #2320), make oath and say:

1. I understand both the German and the English languages;

2. I have carefully compared the annexed translation from German into English with the German Patent Specification Number DE 44 45 588 A 1, entitled "Diaphragm-controlled Differential Pressure Valve"; and

3. The said translation, done by me, is, to the best of my knowledge and ability, a true and correct translation of the said document in every respect.

SWORN before me at the City of)
Toronto, this 18th day of February,)
A.D. 2002.)
)
Maurice Penzo,)
Notary Public in and for the)
Province of Ontario.)

Ilse Wong

MAURICE PENZO, Notary Public, City of T ronto, limited to the attestation of instruments and the taking of affidavits, for All Languages Ltd.
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(71) Anmelder:
Danfoss A/S, Nordborg, DK

(74) Vertreter:
U. Knoblauch und Kollegen, 60320 Frankfurt

(72) Erfinder:
Moelbaek, Jens Joergen, Nordborg, DK

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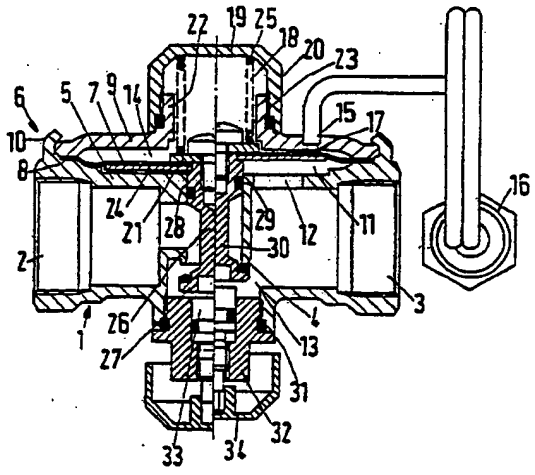
Prüfungsantrag gem. § 44 PatG ist gestellt

(54) Membrangesteuertes Differenzdruckventil

(57) Ein membrangesteuertes Differenzdruckventil, weist ein Ventilgehäuse (1) auf, das einstückig mit dem Unterteil (5) einer Membrandose (6) ausgebildet ist. Der zugehörige Deckel (9) trägt ein die Sollwertfeder (18) aufnehmendes Federgehäuse (20). Dies führt zu einem Ventil mit sehr geringer Bauhöhe.



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Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

Beschreibung

Die Erfindung bezieht sich auf ein membrangesteuertes Differenzdruckventil, mit einem Ventilgehäuse, das einen Einlaß, einen Auslaß und einen mit einem Verschlußstück zusammenarbeitenden Ventilsitz aufweist, und mit einer durch eine Sollwertfeder belasteten Membran, deren äußerer Rand zwischen dem Unterteil und dem Deckel einer Membrandose festgeklemmt ist, deren Zentrum über eine Ventilstange mit dem Verschlußstück verbunden ist und die eine innere und eine äußere Druckkammer voneinander trennt.

Ein solches Differenzdruckventil ist beispielsweise aus EP 0 405 339 A2 bekannt. Es weist ein Ventilgehäuse mit Einlaß, Auslaß und Ventilsitz auf und, getrennt hiervon, eine Membrandose, deren Unterteil einen in das Ventilgehäuse einzuführenden Sockel besitzt, der gleichzeitig eine Durchführung für den mit der Membran verbundenen, das Verschlußstück tragenden Ventilstange bildet. Die Ventilstange ist hohl ausgebildet. Sie enthält mit Bereich der Durchführung einen Kanal, der den Innenraum des Ventilgehäuses mit der inneren Druckkammer verbindet, und ist im Bereich der Membran mit einem großen Hohlraum versehen, in welchem die Sollwertfeder angeordnet ist. In einem zentrischen Fortsatz des Deckels ist eine Stellvorrichtung vorgesehen, mit der die Kraft der Sollwertfeder geändert und der Hub des Verschlußstücks begrenzt bzw. das Ventil völlig geschlossen werden kann. Diese Konstruktion hat eine große Bauhöhe und nimmt in der Einbaustellung einen großen Raum ein.

Der Erfindung liegt die Aufgabe zugrunde, ein Differenzdruckventil der eingangs beschriebenen Art mit geringem Platzbedarf anzugeben.

Diese Aufgabe wird erfindungsgemäß dadurch gelöst, daß das Unterteil der Membrandose einstückig mit dem Ventilgehäuse ausgebildet ist und der Deckel ein die Sollwertfeder aufnehmendes Federgehäuse trägt.

Bei dieser Konstruktion entfällt eine gesonderte Membrandose sowie eine Kupplung zwischen Membrandose und Ventilgehäuse. Dies führt nicht nur zu einer geringen Bauhöhe, sondern auch zu einer erheblichen Verringerung der Herstellungs- und Montagekosten.

Günstig ist es, daß der Durchmesser der Membran nur um höchstens 20% kleiner ist als die zwischen Einlaß und Auslaß gemessene Länge des Ventilgehäuses. Hierbei wird praktisch die gesamte Länge des Ventilgehäuses für das Unterteil der Membrandose ausgenutzt. Es können daher ausreichend große Membranen verwendet werden.

Vorteilhafterweise verlaufen die Innenflächen von Unterteil und Deckel parallel zueinander. Man erhält so eine sehr flache Membrandose, die eine weitere Verringerung der Bauhöhe ermöglicht.

Bei einer bevorzugten Ausführungsform ist dafür gesorgt, daß der Ventilsitz der Membran abgewandt ist und die Ventilstange den Ventilsitz durchsetzt, in einer Bohrung des Ventilgehäuses geführt ist und in der Membrandose mit der Membran verbunden ist. Die sich hierbei ergebende Ventilfunktion ist beispielsweise für ein in die Vorlaufleitung einer Heizungsanlage einzubauendes Differ nzdruckventil geeignet.

Hierbei ist es günstig, daß das Ventilgehäuse auf der der Membran abgewandten Seite eine dem Einführen des Verschlußstücks dienende Montageöffnung aufweist, die durch inen Einsatz verschließbar ist. Auf diese Weise ergibt sich eine sehr einfache Montage des

Verschlußstücks.

Vorteile bietet es ferner, daß der der Membran benachbarte Teil der Ventilstange ine Bohrung im Ventilgehäuse abgedichtet durchsetzt, deren Durchmesser gleich dem Innendurchmesser des Ventilsitzes ist, und daß der dem Verschlußstück benachbarte Teil der Ventilstange einen gegenüber dem Bohrungsquerschnitt kleineren Querschnitt hat. Bei einer solchen Bemessung ergibt sich ein druckentlastetes Ventil.

In weiterer Ausgestaltung empfiehlt es sich, daß das Ventilgehäuse auf der der Membran abgewandten Seite ein manuell von außen zu betätigendes Stellglied zur Begrenzung des Hubs des Verschlußstücks bzw. zum Schließen des Ventils aufweist. Dieses Stellglied kollidiert nicht mit der Membran. Es kann direkt auf das Verschlußstück wirken. Es kann auch mit dem die Montageöffnung verschließenden Einsatz kombiniert sein.

Mit Vorzug weist das Ventilgehäuse einen die innere Druckkammer mit dem Ventilinneren verbindenden Durchbruch auf. Die innere Druckkammer wirkt dann als Eigendruckkammer. Hierfür benötigt man keine Kanäle in der Ventilstange.

Günstig ist es auch, daß die Mündung eines Druckleitungsanschlusses so im Deckel angeordnet ist, daß sie von der Membran verschließbar ist. Wenn die äußere Druckkammer bei eingebauten Differenzdruckventil geöffnet wird, beispielsweise um eine Sollwertfeder auszuwechseln, ergibt sich automatisch eine Abdichtung. Die eingespannte Membran trennt die äußere Druckkammer vom Ventilinnenraum ab und verschließt außerdem den Druckleitungsanschluß.

Es empfiehlt sich, daß das Federgehäuse abnehmbar und die sich an seiner Stirnseite abstützende Sollwertfeder austauschbar ist. Dies führt zu einer sehr einfachen Konstruktion, bei der neue Sollwerte durch einen einfachen Federaustausch erreicht werden.

Hierbei ist es günstig, daß der Deckel einen die Sollwertfeder führenden Hals aufweist, an dessen Außenseite das Federgehäuse befestigt ist. Auf diese Weise hat der Hals eine Doppelfunktion.

Eine ebenfalls empfehlenswerte Alternative besteht darin, daß das Federgehäuse einstückig mit dem Deckel ausgebildet ist und eine von außen drehbare Einstellspindel aufweist, mit der ein drehfest gehaltenes Stützelement zum Abstützen der Feder axial verstellbar ist. Hier kann der Sollwert kontinuierlich verändert werden.

Die Erfindung wird nachstehend anhand in der Zeichnung dargestellter, bevorzugter Ausführungsbeispiele näher erläutert. Es zeigen:

Fig. 1 einen Längsschnitt durch eine erste Ausführungsform eines erfindungsgemäßen Differenzdruckventils und

Fig. 2 einen Längsschnitt durch eine abgewandelte Ausführungsform.

Das in **Fig. 1** gezeigte Differenzdruckventil weist ein Ventilgehäuse 1 mit einem Einlaß 2 und einem Auslaß 3 sowie einem Ventilsitz 4 auf. Die Oberseite des Ventilgehäuses 1 bildet den Unterteil 5 einer Membrandose 6, die sich nahezu über die gesamte axiale Länge des Ventilgehäuses 1 erstreckt. Eine Membran 7 ist mit ihrem äußeren Rand 8 zwischen dem Unterteil 5 und einem Deckel 9 festgekl mmt, wobei ein Bördelrand 10 d s Ventilgehäuses 1 über den Rand des D ckels 9 greift. Die einander zugewandten Flächen v n Unterteil 5 und Deckel 9 verlaufen parallel zu inander.

Die Membran 7 unterteilt die Membrandose 6 in eine innere Druckkammer 11, die über einen Durchbruch 12

in der Gehäusewand mit dem ausgangsseitigen Innenraum 13 des Ventilgehäuses 1 in Verbindung steht, und eine äußere Druckkammer 14, welche über einen Druckleitungsanschluß 15 mit einem Drucksensor 16 verbunden ist. Die Mündung 17 des Druckleitungsanschlusses befindet sich in einem ebenen Abschnitt des Deckels 9, wo sie durch die Membran 7 abgedeckt und damit verschlossen werden kann. Eine Sollwertfeder 18 stützt sich einerseits an der Stirnfläche 19 eines Federgehäuses 20 ab und wirkt andererseits auf eine Membranplatte 21. Die Sollwertfeder 18 wird von einem Hals 22 geführt, an dessen Außenseite ein Gewinde 23 zum Aufschrauben des Federgehäuses 20 vorgesehen ist. Auf diese Weise kann eine Sollwertfeder 18 ausgewechselt werden, um einen gewünschten Sollwert vorzugeben.

Das Zentrum der Membran 7 ist zwischen der Membranplatte 21 und einer Verstärkungsplatte 24 festgeklemmt, wobei eine Schraube 25 die beiden Platten 21 und 24 stirnseitig gegen einen Ventilschaft 26 hält, der am gegenüberliegenden Ende ein Verschlußstück 27 trägt, das mit dem Ventilsitz 4 zusammenwirkt. Das der Membran 7 benachbarte Ende der Ventilstange 26 ist durch eine Bohrung 28 im Ventilgehäuse 1 geführt und dort durch eine Dichtung 29 abgedichtet. Der Durchmesser dieser Bohrung 28 ist gleich dem Innendurchmesser des Ventilsitzes 4. Bohrung 28 und Ventilsitz 4 können in einem Arbeitsgang gebohrt werden. Der dem Verschlußstück 27 benachbarte Teil 30 der Ventilstange 26 hat einen geringeren Querschnitt als die Bohrung 28. Auf diese Weise ergibt sich ein druckentlastetes Ventil.

Auf der der Membran 7 gegenüberliegenden Seite des Ventilgehäuses befindet sich eine Montageöffnung 31, die durch einen einschraubbaren Einsatz 32 verschließbar ist. Im Einsatz ist ein Stellglied 33 angeordnet, das mit Hilfe des Drehgriffs 34 verschraubbar und dadurch axial verstellbar ist. Mit diesem Stellglied 33 kann der Hub des Verschlußstücks 27 begrenzt und gewünschtenfalls das Ventil auch vollständig geschlossen werden.

Bei der Montage wird die Membran 7 mit Membranplatte 21 und Verstärkungsplatte 24 an Ort und Stelle gebracht. Alsdann wird die Ventilstange 26 durch die Montageöffnung 31 eingeführt und durch die Schraube 26 mit dem Membranzentrum verbunden. Danach wird der Einsatz 32 in die Montageöffnung 31 geschraubt und der Deckel 9 an Ort und Stelle gebracht und durch Umbördeln des Bördelrandes 10 befestigt. Nach Wahl der gewünschten Sollwertfeder 18 kann das Federgehäuse 20 aufgeschraubt werden. Gegebenenfalls läßt sich die Ventilstange 26 auch erst anbringen, nachdem der Deckel 9 mit dem Unterteil 5 verbunden worden ist.

Das Federgehäuse 20 kann auch während des Betriebes abgenommen werden. Die Membran 7 verhindert einen Wasseraustritt aus dem Ventilinneren und durch Abdeckung der Mündung 17 einen Wasseraustritt aus dem Drucksensor 16.

Das Ausführungsbeispiel der Fig. 2 unterscheidet sich von demjenigen der Fig. 1 nur in der Ausgestaltung des Deckels 35, der einstückig mit einem Federgehäuse 36 ausgebildet ist. Die Sollwertfeder 37 stützt sich an einem drehfest gehaltenen Stützelement 38 ab, das mit Hilfe einer Einstellspindel axial verstellbar ist. Zu diesem Zweck besitzt die Einstellspindel 39 einen Innensechskant 40 zum Drehen und ein Außengewinde 41 für die Axialverstellung des Stützelements 38. Eine solche Sollwertfeder 37 kann kontinuierlich verstellt werden.

In beiden Ausführungsformen bildet die innere Druckkammer 11 eine Eigendruckkammer, welche vom Ausgangsdruck des Ventils beaufschlagt ist. Ein solches Ventil kann insbesondere in die Vorlaufleitung einer Heizungsanlage eingebaut werden, wobei die obere Druckkammer 14 mit dem Rücklaufdruck versorgt wird. Die Grundidee der Erfindung läßt sich aber auch bei solchen Differenzdruckventilen anwenden, bei denen die innere Druckkammer 11 mit dem Eingangsdruck beaufschlagt wird, wie dies beispielsweise bei im Rücklauf einer Heizungsanlage angeordneten Ventilen der Fall ist.

Patentansprüche

1. Membrangesteuertes Differenzdruckventil, mit einem Ventilgehäuse, das einen Einlaß, einen Auslaß und einen mit einem Verschlußstück zusammenarbeitenden Ventilsitz aufweist, und mit einer durch eine Sollwertfeder belasteten Membran, deren äußerer Rand zwischen dem Unterteil und dem Deckel einer Membrandose festgeklemmt ist, deren Zentrum über eine Ventilstange mit dem Verschlußstück verbunden ist und die eine innere und eine äußere Druckkammer voneinander trennt, **dadurch gekennzeichnet**, daß das Unterteil (5) der Membrandose (6) einstückig mit dem Ventilgehäuse (1) ausgebildet ist und der Deckel (9; 35) ein die Sollwertfeder (18; 37) aufnehmendes Federgehäuse (20; 36) trägt.
2. Ventil nach Anspruch 1, dadurch gekennzeichnet, daß der Durchmesser der Membran (7) nur um höchstens 20% kleiner ist als die zwischen Einlaß (2) und Auslaß (3) gemessene Länge des Ventilgehäuses (1).
3. Ventil nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die Innenflächen von Unterteil (5) und Deckel (9) parallel zueinander verlaufen.
4. Ventil nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Ventilsitz (4) der Membran (7) abgewandt ist und die Ventilstange (26) den Ventilsitz (4) durchsetzt, in einer Bohrung (28) des Ventilgehäuses (1) geführt ist und in der Membrandose (6) mit der Membran (7) verbunden ist.
5. Ventil nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß das Ventilgehäuse (1) auf der der Membran (7) abgewandten Seite eine dem Einführen des Verschlußstücks (27) dienende Montageöffnung (31) aufweist, die durch einen Einsatz (32) verschließbar ist.
6. Ventil nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der der Membran (7) benachbarte Teil der Ventilstange (26) eine Bohrung (28) im Ventilgehäuse (1) abgedichtet durchsetzt, deren Durchmesser gleich dem Innendurchmesser des Ventilsitzes (4) ist, und daß der dem Verschlußstück (27) benachbarte Teil (30) der Ventilstange (26) einen gegenüber dem Bohrungsquerschnitt kleineren Querschnitt hat.
7. Ventil nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß das Ventilgehäuse (1) auf der der Membran (7) angewandten Seite ein manuell von außen zu betätigendes Stellglied (33) zur Begrenzung des Hubs des Verschlußstücks (27) bzw. zum Schließen des Ventils aufweist.
8. Ventil nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß das Ventilgehäuse (1) einen die innere Druckkammer (11) mit dem Ventilinneren (13) verbindenden Durchbruch (12) aufweist.
9. Ventil nach einem der Ansprüche 1 bis 8, dadurch

gekennzeichnet, daß die Mündung (17) eines Druckleitungsanschlusses (15) so im Deckel (9) angeordnet ist, daß sie v n der Membran (7) verschließbar ist.

10. V ntil nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß das Federgehäuse (20) abnehmbar und die sich an seiner Stirnseite abstützende Sollwertfeder (18) austauschbar ist.

11. Ventil nach Anspruch 10, dadurch gekennzeichnet, daß der Deckel (9) einen die Sollwertfeder (18) führenden Hals (22) aufweist, an dessen Außenseite das Federgehäuse (20) befestigt ist.

12. Ventil nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, daß das Federgehäuse (36) einstückig mit dem Deckel (35) ausgebildet ist und eine von außen drehbare Einstellspindel (39) aufweist, mit der ein drehfest gehaltenes Stützelement (38) zum Abstützen der Feder (37) axial verstellbar ist.

Hierzu 1 Seite(n) Zeichnungen

– Leerseite –

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Fig.1

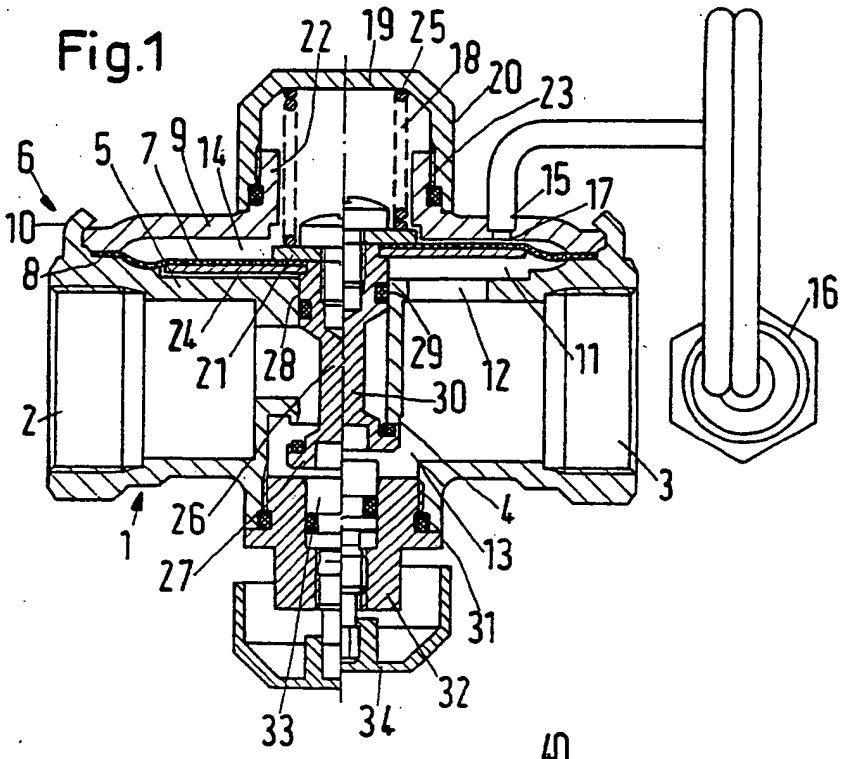
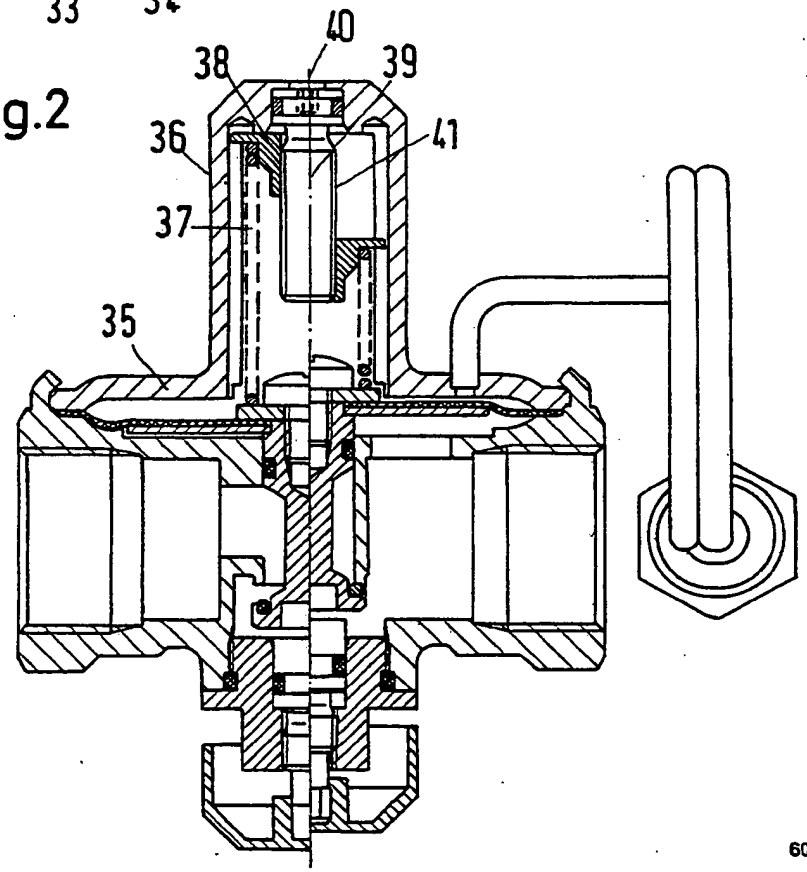


Fig.2



True translation of

Statement of disclosure
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Applicant
Danfoss A/S, Nordborg, Denmark

Inventor
Moelbaek, Jens Joergen, Nordborg, Denmark

Representatives
U. Knoblauch & Partners, 60320 Frankfurt

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An application of examination according to article 44 PatG has been made

Diaphragm-controlled pressure differential valve

A diaphragm-controlled pressure differential valve features a valve chamber (1) that is developed solidly with the bottom part (5) of a diaphragm box (6). The lid (9) belonging to it bears a spring barrel (20) that accepts the set point spring (18). This creates a valve with an extremely low module height.

Description

The invention refers to a diaphragm controlled pressure differential valve, with a valve chamber that features an intake, a discharge, and a valve face that works in conjunction with a locking piece, and a diaphragm loaded with a set point spring, which exterior rim is pinched between the bottom part and the lid of a diaphragm box which centre is connected to the locking piece through a valve stem and which separates an internal and an external pressure chamber.

Such a pressure differential valve is known through e.g. EP 0 405 339 A2. It features a valve chamber with intake, discharge and valve face, and separated from it, a diaphragm box which bottom part owns a base that is to be inserted into the valve chamber and which at the same time forms a bushing for the valve stem which is connected to the diaphragm and makes the locking piece. The valve stem has been designed as hollow. In the area of the bushing it contains a channel that connects the interior of the chamber with the interior pressure chamber, and features a large hollow space in the area of the diaphragm where the set point spring is set. A regulating device is planned in a centric extension of the lid with which the force of the set point spring can be adjusted and the stroke of the locking piece can be limited, respectively the valve be completely closed. This design demands a large overall height and takes up a lot of space in the mounting position.

The invention is based on the requirement to indicate a pressure differential valve of the type described in the beginning, with a small space requirement.

This requirement is resolved in the invention by developing solidly the bottom part of the diaphragm box with the valve chamber and having the lid bear a spring barrel that accepts the set point spring.

In this design, a separate diaphragm box is unnecessary, as is a coupling between diaphragm box and valve chamber. This leads not only to a low overall height but also to an extensive reduction in production and assembly costs.

It is advantageous that the diameter of the diaphragm is of a maximum 20% smaller than the length of the valve chamber as measured between intake and discharge. This means that practically the total length of the valve chamber is used for the bottom part of the diaphragm box, which leads to the use of sufficiently large diaphragms.

As an advantage, the interior surfaces of the bottom part and the lid are in parallel. Thus, a very shallow diaphragm box is achieved that results in a further reduction of the overall height.

A preferred model provides that the valve face is turned away from the diaphragm and the valve stem penetrates the valve face, is guided through a bore in the valve chamber and connected with the diaphragm inside the diaphragm box. The resulting valve function is suitable for e.g. a pressure differential valve inside the flow pipe of a heating system. In this respect, it is of an advantage that the valve chamber features a mounting hole on the side turned away from the diaphragm, designed for the insertion of the locking piece and which can be closed through an insert. This results in a very easy mounting of the locking piece.

It is also advantageous that the part of the valve stem next to the diaphragm penetrates a sealed bore in the valve chamber, which diameter is equal to the interior diameter of the valve face, and that the part of the valve stem next to the locking piece has a smaller cross section than the bore cross section.

In a further construction it is recommended that the valve chamber features an actuator on the side turned away from the diaphragm. This actuator should be manually operated from the outside and will limit the stroke of the locking piece, respectively close the valve. The actuator does not collide with the diaphragm and can act directly on the locking piece. However, it can also be combined with the insert that closes the mounting hole.

Preferably, the valve chamber features an opening that connects the interior pressure chamber with the interior of the valve. In this case, the interior pressure chamber acts as an inherent pressure chamber. For this, no channels on the valve stem are required.

It is also an advantage that the mouth of the pressure tube connection has been arranged in the lid in such a manner that it can be closed by the diaphragm. If the external pressure chamber with a built-in differential pressure valve is opened, in order to e.g. exchange a set point spring, then this results automatically in a sealing. The clamped down diaphragm separates the external pressure chamber from the interior space of the valve and additionally closes the pressure tube connection.

An added feature is that the spring barrel can be taken off and that the set point spring that is propped by its face side is exchangeable. This leads to a very simple design where new set points are achieved by a simple exchange of springs.

This is simplified by the fact that the lid features a neck that leads to the set point spring on which exterior the spring barrel is mounted. Thus the neck has a dual functionality.

Another valuable alternative consists of the solid development of the spring barrel with the lid and which features an adjustment spindle that can be turned from the outside and which adjusts axially an element resistant to torsion that supports the spring. Thus, the set point value can be changed incrementally.

Below, the invention is explained in more detail and with the use of an illustration. It is shown:

Figure 1 – a cross section through a first model according to the invented differential pressure valve and

Figure 2 – a lengthwise cross section through a modified type.

The pressure differential valve shown in figure 1 features a valve chamber with an intake 2 and a discharge 3, as well as a valve face 4. The upper side of the valve chamber 1

forms the bottom part 5 of a diaphragm box 6, that extends over nearly the whole axial length of the valve chamber 1. Diaphragm 7 is clamped down with its exterior rim 8 between bottom part 5 and lid 9, where a flared flange 10 of the valve chamber 1 reaches over the rim of lid 9. The surfaces facing each other of bottom part 5 and lid 9 are in parallel.

Diaphragm 7 divides diaphragm box 6 in a) an internal pressure chamber 11 that is connected to the discharge sided interior room 13 of the valve chamber, via a bore 12 in the chamber wall; and b) an external pressure chamber 14 which is connected to a pressure sensor 16 through a pressure tube connection. The mouth 17 of the pressure tube connection is in a level section of lid 9 where it can be covered by diaphragm 7 and thus be closed. A set point spring 18 is on the one side, supported by frontal area 19 of a spring barrel 20 and acts, on the other hand, on a diaphragm plate 21. Set point spring 18 is led by neck 22 on which exterior side a thread 23 is shown for the screwing on of spring barrel 20. In this manner, set point spring 18 can be exchanged in order to specify a desired set point.

The centre of diaphragm 7 is clamped down between diaphragm plate 21 and a reinforcing plate 24, where a screw 25 holds both plates 21 and 24 on their face side against a valve shaft 26 that carries on the opposite side a locking piece 27 that interacts with valve face 4. The end of the valve stem 26 next to diaphragm 7, is guided through bore 28 in valve chamber 1 and there sealed by gasket 29. The diameter of this bore 28 is equal to the interior diameter of valve face 4. Bore 28 and valve face 4 can be drilled in a single procedure. Part 30 of valve stem 26 which is next to locking piece 27 has a smaller diameter than bore 28. Thus, a pressure-relieve valve is created.

On the side of the valve chamber that is opposite to diaphragm 7, a mounting hole 31 can be found that can be closed with a screw-in insert 32. In this insert, actuator 33 is mounted which can be screwed with the aid of knob lever 34 and thus be adjusted axially. With actuator 33, the stroke of locking piece 27 can be limited or, if desired, the valve can be closed completely.

During assembly, diaphragm 7 will be positioned with diaphragm plate 21 and reinforcing plate 24. Then, valve stem 26 is inserted through mounting hole 31 and connected with the diaphragm centre via screw 26. After this, insert 32 is screwed into mounting hole 31 and lid 9 is positioned and fastened through crimping of the flared flange 10. After selecting the required set point spring 18, the spring barrel 20 can be screwed on. Where required, valve stem 26 may be attached only after lid 9 has been connected to bottom part 5.

Spring barrel 20 may be taken off during operation. Diaphragm 7 prevents a water leakage from the valve interior and also, due to the covering of mouth 17, water leakage from pressure sensor 16.

The type shown in figure 2 is different from the one in figure 1 only in the design of lid 35, which is designed as a solid unit with spring barrel 36. Set point spring 37 is supported by supporting element 38 that is resistant to torsion and can be adjusted axially by an adjustment spindle. For this purpose, adjustment spindle 39 features a hexagon socket 40 to turn and an outside thread 41 for the axial adjustment of supporting element 38. Such a set point spring can be adjusted incrementally.

In both design types, interior pressure chamber 11 is an inherent pressure chamber which is impinged by the outgoing pressure of the valve. Such a valve is suitable for mounting in the flow pipe of a heating system where the upper pressure chamber 14 is supplied by the return pipe pressure. The basic idea of the invention can also be applied to such pressure differential valves where the interior pressure chamber 11 is impinged by intake pressure, as is usually the case in valves used in the return pipe of a heating system.

Patent Claims

1. Diaphragm-controlled pressure differential valve, with a valve chamber that features an intake, a discharge and a valve face that is in cooperation with a locking piece; and a diaphragm that is loaded with a set point spring. The external rim of the diaphragm is clamped between the bottom part and the lid of a diaphragm box, which centre is connected with the locking piece through a valve stem and which separates an interior and an exterior pressure chamber; characterized that the bottom part (5) of the diaphragm box (6) is built as a solid unit with valve chamber (1) and the lid (9, 35) bears the spring barrel (20, 36) of the set point spring (18, 37).
2. Valve according to claim 1, characterized by diameter of diaphragm (7) to be smaller by a maximum of 20% then the length of the valve chamber measured between intake (2) and discharge (3).
3. Valve according to claim 1 or 2, characterized by that the interior surfaces of bottom part (5) and lid (9) are in parallel to each other.
4. Valve according to one of the claims 1 through 3, characterized by the valve face (4) being turned away from the diaphragm (7) and the valve stem (26) penetrates the valve face (4), is guided in a bore (2) of the valve chamber (1) and connected with the diaphragm (7) in the diaphragm box (6).
5. Valve according to one of the claims 1 through 4, characterized by the valve chamber (1) features a mounting hole (31) on the side turned away from the diaphragm (7) which is designed to insert the locking piece (27) and which can be closed with an insert (32).
6. Valve according to one of the claims 1 through 5, characterized by that a sealed bore (28) in the valve chamber (1) penetrates at that part of the valve stem (26) that is next to the diaphragm (7). Also, that the

diameter of the bore (28) is equal to the internal diameter of the valve face (4) and that the part (30) of the valve stem (26) that is next to the locking piece (27) has a smaller diameter than the bore.

7. Valve according to one of the claims 1 through 6; characterized by the valve chamber (1) features a manual actuator (33) on the side turned towards the diaphragm; this actuator to be operated from the outside, limits the stroke of the locking piece (27), respectively closes the valve.
8. Valve according to one of the claims 1 through 7, characterized by the valve chamber (1) featuring an opening (12) that connects the internal pressure chamber (11) with the interior of the valve (13).
9. Valves according to one of the claims 1 through 8, characterized by the fact that the mouth (17) of a pressure pipe connection (15) has been positioned in the lid (9) in such a manner that it can be closed by the diaphragm (7).
10. Valve according to one of the claims 1 through 9, characterized by the fact that the spring barrel (20) can be removed that the set point spring (18), that is supported on its front side, can be exchanged.
11. Valve according to one of the claims 1 through 10, characterized by the fact that the lid (9) features a neck (22) that leads to the set point spring (18) and that the spring barrel (20) is mounted on the outside of the neck (22).
12. Valve according to one of the claims 1 through 11, characterized by the fact that the spring barrel (36) is designed as a solid unit with the lid (35) and that it features an adjustment spindle (39) that can be turned from the outside and with which a supporting element (38) that is resistant against torsion can be adjusted axially; and that this supporting element is used for a propping up of the spring (37).

1 page of drawings to this